Preventing Secondary Infections Among HIV-Positive Persons

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Synopsis

Secondary infectious diseases contribute substantially to morbidity and mortality of people infected with human immunodeficiency virus (HIV). The authors developed comprehensive, practical recommendations for prevention of infectious complications in HIV-infected people. Recommendations are concerned with the pathogens that are more common or more severe in HIV-infected people.

Several infectious complications can be prevented by avoiding ingestion of contaminated food or water. Zoonoses can be prevented by precautions to be taken in contacts with animals. The risk of several fungal diseases can be reduced if activities likely to lead to inhalation of spores are avoided. HIV-infected people should be advised how to lower adverse health effects of travel, especially international travel. The potential for infectious complications of sexual activity and illicit drug use should be stressed, and recommendations to reduce the risk are discussed.

Recommendations for use of vaccines in HIV-infected people are reviewed. Blood CD4+ lymphocyte concentrations, tuberculin skin testing, Toxoplasma *serology, and sexually transmitted disease screening should be performed in certain subsets of HIV-infected people. Guidelines for chemoprophylaxis against* Pneumocystis carinii *and tuberculosis are presented. Recent data suggest that intravenous immunoglobulin therapy may prevent bacterial infections in HIV-infected children.*

IMMUNE DYSFUNCTION from human immunodeficiency virus (HIV) infection allows infectious complications to develop in most HIV-infected people. Many infectious diseases that complicate HIV infection are preventable, some by behavioral changes and risk avoidance, others by immunization or chemotherapy. Prevention of secondary infectious diseases would substantially improve the lives of many HIV-infected people. Based on literature review and clinical experience, we have developed a set of recommendations for the prevention of secondary infectious diseases more likely to occur or likely to be more severe in people with HIV infection. Our recommendations expand upon previous ones concerned solely with food counseling for HIV-infected people (*1,2*). A videotape concerning safe food preparation and eating habits (*3*) is a useful teaching tool.

Although there may be differences in virulence (*4*), both HIV-1 and HIV-2 can lead to acquired immunodeficiency syndrome (AIDS) (*5*), and these recommendations apply to people infected with either HIV-l or HIV-2. Immunosuppression from HIV infection may develop precipitously and unpredictably, and some pathogens may be acquired early during HIV infection. HIV-infected people should be given these recommendations when HIV infection is first diagnosed.

Preventable infectious complications are discussed by etiology in the text. In the box on page 504, preventive measures are listed by the activity or exposure that might place someone at risk for a secondary infection. The list is organized for ease of use with patients.

Specific Infectious Diseases

Gastrointestinal diseases. *Salmonella* (*6–9*), *Campylobacter* (*10, 11*), *Cryptosporidium* (*12*), and *Isospora belli* (*13, 14*) are important gastrointestinal pathogens in HIV-infected people. *Giardia lamblia* infections are common in gay men, but they do not seem to be more severe or persistent in people with HIV infection (*15*).

Salmonellae are usually acquired from animals or animal products including meat, poultry, milk, and

Summary of Recommendations to be Given to HIV-Infected Persons to Prevent Secondary Infectious Diseases

Personal hygiene. Simple hygienic techniques to prevent fecal-oral spread of pathogens:

- Wash hands after using the toilet, changing diapers, or touching objects that may be contaminated with feces; and
- Food preparers (HIV-infected or not) should wash hands before preparing food.

Susceptible HIV-infected people should avoid contact with persons with contagious measles, varicella, or tuberculosis.

Food. Eat meat, poultry, eggs, or seafood only after they have been cooked. Eat hollandaise sauce, meringue, caesar and certain other salad dressings, frosting, eggnog, ice cream, mayonnaise, and uncooked dough only if made with cooked or pasteurized eggs. Use only pasteurized or cooked milk from cattle and other animals. Wash or cook produce. HIV-infected persons and food preparers should practice good kitchen hygiene to prevent cross contamination.

Water. Use water from municipal systems or properly constructed wells in the United States or other developed countries. In less developed countries, use bottled or canned *carbonated* water or beverages or sterilized water.

Animal contact. Avoid contact with turtles and perhaps other reptiles. Take steps to prevent fecal-oral spread from animals:

- Wash hands after contact.
- Do not eat or drink during activities that involve animal contact.
- Wear gloves for exposure to bodily cavities or secretions.
- Inform HIV-infected people of the small but definite risk of toxoplasmosis and cat-scratch disease from cat contact. If they wish to keep cats, they should be advised (*a*) that cats should be kept indoors, fed only cooked food, and kept away from cats that may be exposed to *Toxoplasma gondii* and from potentially infected prey; (*b*) avoid handling cat litter. Litter boxes should be cleaned daily by others to prevent oocysts from sporulating in the litter pan. Dust from the litter may contain oocysts and exposure by inhalation should be avoided. (*c*) Persons handling cats or litter should wash their hands afterwards, especially before preparing food. (*d*) A special assessment of risk exposure should be made for HIV-infected children or for mentally impaired HIV-infected adults. (*e*) Avoid being scratched by a cat.

Outdoor activities. Wash hands after gardening and other soil contact. Avoid puncture wounds from thorns and slivers. Avoid working with peat moss. In the Lower Sonoran Life Zone avoid inhaling dust or soil, disturbing soil near rodents' nests, and activities such as horseback riding and excavating that raise clouds of dust. Stay indoors on particularly dusty days. The risk of coccidioidial infection is highest in the dry season (mid- to late summer in North America).

Avoid chicken or pigeon coops, bird roosts, bird-inhabited places (barns, attics, and so forth) and bat-inhabited caves, where soil is contaminated with feces. Avoid dust created when the soil from these places becomes airborne, such as during excavations, for example. Avoid dust from decayed trees that are disturbed or cut.

Travel. Be aware of the hazards of travel and how to reduce the risk of acquiring infections during travel.

Sexual practices. Abstain from sex, limit contacts, or practice safer sex.

Intravenous drugs. Do not use illicit drugs; users are urged to obtain treatment. Persistent users should use sterile or sterilized needles.

Baseline testing and monitoring. The following are recommended procedures.

- CD4+ lymphocyte concentration testing every 6 months in certain HIV-infected people to determine the need for zidovudine or prophylaxis against *Pneumocystitis carinii* pneumonia,
- tuberculin skin testing,
- *Toxoplasma* serology, and
- screening of HIV-infected people at risk for syphilis and *Chlamydia trachomatis.*

Vaccines. Vaccines recommended for all HIV-infected persons are pneumococcus and influenza vaccines. Vaccines recommended for the same indications in HIV-infected people as in other persons are hepatitis B, measles, mumps, rubella, poliomyelitis (inactivated), and BCG, if the risk of tuberculosis is $\geq$ 1 percent per year. Vaccinia virus vaccine should not be used in HIV-infected people.

Chemoprophylaxis. Zidovudine should be given to people with AIDS and to HIV-infected people with $\leq$ 500 CD4+ lymphocytes per microliter of blood. Chemoprophylaxis against *P. carinii* pneumonia should be used for HIV-infected people who have had one episode of this disease or for people with $\leq$ 200 CD4+ lymphocytes per microliter of blood. Isoniazid should be used for HIV-infected people infected with *Mycobacterium tuberculosis* and not yet ill, or those at extremely high risk of tuberculosis.

eggs (*16–19*). Cross-contamination in the kitchen is a major, often unrecognized source of salmonellae. Contaminated water (*20*) and person-to-person spread are other important means of spread. Typhoid fever was commonly associated with seafood ingestion in earlier decades (*21, 22*). Transmission of *Salmonella typhi* is still likely in developing parts of the world where untreated sewage is often discharged into coastal waters inhabited by shellfish.

Turtles are often colonized with salmonellae, and pet turtle contact is an important source of human salmonellosis for HIV-infected persons and others (*23*). There is no reliable way to eradicate salmonellae from turtles once they have become infected. Other reptiles carry salmonellae also (*24*), but the association with human salmonellosis is not as strong.

Killed typhoid vaccines available in the United States are only 51 to 77 percent effective in persons with intact immunity and are associated with frequent, adverse reactions (*25*). The efficacy of killed typhoid vaccines for HIV-infected people has not been reported. A recently licensed live-attenuated vaccine has similar efficacy in people with intact immunity and is associated with fewer side effects, but it is not recommended for use in immunosuppressed people (*25*).

Campylobacter is transmitted to humans through contaminated meat, poultry, eggs, unpasteurized milk, water, animal contact, or person-to-person spread. *Giardia* is transmitted by contaminated water and person-to-person spread and less commonly by food. *Cryptosporidium* is transmitted through contaminated water (*26*), person-to-person spread, and animal contact (*12, 27, 28*). The exact mode of *I. belli* transmission is not well documented in the United States, but it is thought to be spread to humans from other animals (*13*).

Prevention: food and water. HIV-infected people should eat meat, poultry, seafood, or eggs only after these foods have been properly cooked. Raw eggs may be unrecognized in some foods, including some preparations of hollandaise sauce, meringue, caesar and certain other salad dressings, frosting, egg nog, ice cream, mayonnaise, and dough. Unpasteurized ("raw") milk should not be ingested alone or in other foods unless they are cooked. HIV-infected people should be instructed on proper hygienic techniques to prevent cross-contamination in the kitchen (*3*).

Water should be taken from municipal water systems or properly constructed wells. HIV-infected people should not drink untreated surface water from streams, rivers, or lakes or from unsafe wells. Alternatively, water from unsafe sources can be disinfected, preferably by boiling (*29*, also see subsequent section on travel).

Preventing fecal-oral spread. HIV-infected persons should be instructed in simple hygienic practices to prevent fecal-oral spread. They should be advised to wash hands after using the toilet, before preparing food, and after handling objects potentially soiled with feces (for example, diapers). Sexually active people should be told of the potential for some sexual practices to transmit enteric pathogens; for example, oral-anal or oral-genital sex (*30—32*).

Prevention: reptiles and other animals. HIV-infected people should avoid contact with turtles, especially pet turtles or turtles from commercial sources. Although the risk from contact with other reptiles appears to be less, it may be prudent to avoid contact with them as well. If reptiles are handled, hands should be washed afterwards.

HIV-infected people in contact with animals should take steps to prevent fecal-oral spread. Hands should be washed after animal contact, and eating or drinking should not occur during activities that involve animal contact. HIV-infected people with extensive exposure to animals (for example, farmers, veterinarians) should wear gloves for exposure to mucous membranes, secretions, or tissues of animals.

Pneumococcal infections. Severe pneumococcal infections are common in people with AIDS (*33–35*). Unfortunately, HIV-infected people do not produce antibodies in response to pneumococcal vaccines as well as other people (*36–40*). The worse the underlying immunosuppression, the poorer the response. There are no data on efficacy of pneumococcal vaccines in HIV-infected people.

Prevention. Pneumococcal vaccines have been recommended for all HIV-infected people (*41*).

***Haemophilus influenzae* infections.** Severe *H. influenzae* infections are common in people with AIDS (*34*). *H. influenzae* protein-conjugate vaccines have been shown to be effective and safe for prevention of *H. influenzae* disease in people without HIV infection. However, HIV-infected people do not produce antibodies as well as other persons (*42, 43*). There are no data on efficacy of these vaccines in HIV-infected people.

Prevention. H. influenzae vaccine has been recommended for children with HIV infection according to the usual schedule (*44, 45*).

Tuberculosis. *Mycobacterium tuberculosis* infection and disease are common in some subsets of HIV-infected people (*46–50*). Early in HIV infection, persons also infected with *M. tuberculosis* usually have positive skin-test reactions. When clinical tuberculosis occurs in this stage, it is usually typical. With increasing immunosuppression in later stages of HIV infection, anergy to tuberculin in persons also infected with *M. tuberculosis* becomes increasingly likely (*47*), and cases of active tuberculosis are often atypical. These trends make *M. tuberculosis* infection and disease more difficult to diagnose and promptly treat as HIV infection progresses.

Prevention measures. HIV-infected people should avoid contact with people who have respiratory-tract tuberculosis until the risk of contagion is over, generally thought to be 1 week after effective chemotherapy has been started.

Mantoux skin tests with tuberculin (5 units) and control antigens should be given to all people presenting with HIV infection *(47)*. If the tuberculin test is positive, defined for this population as ≥ 5 millimeters induration (*47*), active tuberculosis should be excluded by history, physical examination, chest roentgenogram, and other clinically indicated tests. Reactions to tuberculin and control antigens are often falsely negative in persons with advanced immunosuppression.

HIV-infected people with a positive tuberculin skin test should receive chemoprophylaxis with isoniazid unless isoniazid-resistant *M. tuberculosis* is suspected (*47*). The recommended duration is at least 12 months. There are no data on efficacy of chemoprophylaxis in HIV-infected people, but isoniazid and other drugs are nearly as effective for treatment of active tuberculosis in HIV-infected people as in others. It is generally believed that chemoprophylaxis is effective. Consideration should be given to isoniazid prophylaxis for anergic HIV-infected persons with known prior exposure, skin test-negative HIV-infected people at extremely high risk of tuberculosis, or people at high risk of tuberculosis and HIV infection who refuse HIV testing (*47*).

Bacillus Calmette-Guérin (BCG) vaccine is used to prevent tuberculosis in populations with high risk (that is $\geq$ 1 percent annual risk of infection [*47, 51*]). It is not currently recommended in U.S. populations because the risk is not this high. BCG vaccine can cause progressive or disseminated disease in people with severe immunosuppression, including symptomatic HIV infection (*52, 53*), but the risk appears to be low for people with HIV infection that is not far advanced.

***Rhodococcus equi* infections.** *Rhodococcus equi* (formerly *Corynebacterium equi*) is a common soil organism and animal pathogen. *R. equi* infections have been reported in people with AIDS (*54*) and other immunosuppressive conditions (*55*). Not all infected people have had unusual animal or soil contact, and the degrees of risk associated with such contact and modes of transmission are not yet clear.

Prevention. HIV-infected people in contact with animals should take steps to prevent fecal-oral spread as described previously.

***Vibro* infections.** Bivalve mollusks (oysters, clams, mussels, and cockles) and marine crustaceans (shrimp, crabs, and lobsters) are filter-feeders, which concentrate microorganisms in their environments (*21, 56*). Noncholera *Vibrio* species (*57, 58*) have received recent attention, but *Vibrio cholerae* (*59*) has also been acquired by ingestion of seafood. Disease may result unless these foods are thoroughly cooked. There is evidence suggesting that HIV infection may increase the severity of noncholera *Vibrio* disease (*60*).

Prevention. HIV-infected people should ingest seafood only after it has been thoroughly cooked.

***Listeria* infections.** Listeriosis has been reported in persons with HIV infection (*61–68*). The incidence appears to be substantially increased over that in the general population (*61, 68, 69*), although it is less than might have been anticipated given the importance of T cell-mediated immunity in listeriosis (*70*). Listeria infections in humans have been associated with ingestion of unpasteurized milk, cheeses made with unpasteurized milk, and contaminated produce (*69*).

Prevention. HIV-infected people should use only milk that has been pasteurized or milk products made with pasteurized milk. Produce should be washed or cooked, or both.

Syphilis. Sexually transmitted diseases (STD) are common in many groups at risk for HIV infection.

Syphilis appears to be more difficult to treat in people who are also infected with HIV (*71, 72*).

Prevention. A nontreponemal antibody test for syphilis (for example, rapid plasma reagin [RPR] test, Venereal Disease Research Laboratory [VDRL] test, or automated reagin test) should be performed initially for HIV-infected persons who are also in groups at high risk for syphilis. Positive tests should be confirmed by treponemal antibody tests (for example, *Treponema pallidum*, hemagglutination test, fluorescent treponemal antibody-absorbed test, or treponemal immobilization test). Those with positive syphilis serology should be treated according to guidelines for HIV-infected people (*71, 72*). (Also see the subsequent section on sexually transmitted diseases.)

Cat-scratch disease. A syndrome resembling cat-scratch disease has been described in several HIV-infected people, many of whom have had contact with cats (*73–77*). Bacilli resembling the cat-scratch agent have been found in tissues from these patients. The histopathology in HIV-infected people has differed from histopathology in people with intact immunity. Whether this reflects differences in infectious agent, host defenses, or mode of transmission has not been determined. Presently, it appears that there is a small but definite risk of severe bacterial infection in HIV-infected people from cat contact, especially from cat scratches.

Prevention. HIV-infected people should be advised of the potential risk of cat contact so that they can make an informed choice about whether to keep cats. HIV-infected people should avoid being scratched by cats.

***Pneumocystis carinii* infections.** As immunity declines, *P. carinii* pneumonia becomes one of the most common complications of HIV infection. Primary prophylaxis has been shown to prevent *P. carinii* pneumonia in people with advanced HIV-induced immunosuppression (*78–80*). Recurrences are common in HIV-infected people who have had one episode, and secondary chemoprophylaxis to prevent them is widely practiced (*79, 81*).

Prevention. People who have had pneumocystis pneumonia should receive secondary chemoprophylaxis to prevent repeated episodes (*80*). Other HIV-infected people should have CD4+ lymphocytes quantified in blood samples periodically to determine the need for primary prophylaxis. People with $\leq$ 200 CD4+ lymphocytes per microliter of blood, or in whom CD4+ lymphocytes constitute $<$ 20 percent of blood lymphocytes, should receive primary chemoprophylaxis (*78–80*). Chemoprophylaxis usually consists of oral cotrimoxazole or inhaled pentamidine, but there are alternatives (*82*).

Toxoplasmosis. Depending on where they live, from 15 to 85 percent of adults have been infected with *Toxoplasma gondii*. Tissue cysts remain viable for life, and immunoglobulin G (IgG) antibodies to *T. gondii* are usually detectable in infected people, even in those with HIV infection. In approximately 30 percent of people infected with both HIV and *T. gondii* infections, the *T. gondii* infection will eventually reactivate and lead to clinical disease (*83*). Reactivation is responsible for more than 95 percent of toxoplasmosis cases in HIV-infected people in the United States (*84*), but in some countries, primary *T. gondii* infections appear to be more common (*85*).

Initial, baseline testing for IgG antibodies to *T. gondii* identifies most people at risk for reactivation as HIV-related immunosuppression progresses (*83–85*). In people with intact host defenses, prior infection with *T. gondii* protects against disease from reexposure to *T. gondii*, but the extent to which this is true for HIV-infected people has not been determined. Studies of the efficacy of chemoprophylaxis to prevent the reactivation of dormant *T. gondii* infection in HIV-infected people are underway.

T. gondii is transmitted to humans through ingestion of meat (*86*), unpasteurized milk (especially goat milk [*87*]), or through ingestion of oocysts. Oocysts are a highly infective form of *T. gondii* shed by members of the cat family. Cats are infected when they ingest raw meat containing tissue cysts or oocysts from other cats. Domestic cats excrete oocysts beginning 3 to 24 days after primary infection. Oocyst excretion usually lasts 7 to 20 days. Oocysts are not infectious for humans until they sporulate, which takes 2 or 3 days at 24 degrees Celsius or up to 21 days at colder temperatures. Once sporulated, oocysts remain infectious under favorable conditions of light and humidity for more than a year. There is evidence to suggest that oocysts airborne in dust may infect humans (*88*). Cats are resistant to reinfection, but they may excrete *T. gondii* oocysts long after primary infection, especially after infection with *Isospora* species, or closely related coccidia (*89, 90*). Reliable serologic tests for cats are unavailable.

Soil contaminated with cat feces may contain *T.*

gondii oocysts, and there is evidence that it may transmit *T. gondii* to humans (*88, 91—93*). Produce in contact with cat feces may be contaminated with *T. gondii* oocysts. The risk is probably reduced if produce is peeled and washed before ingestion, and the risk is eliminated if produce is well-cooked.

Prevention measures. HIV-infected people should be informed of the risk of toxoplasmosis from cats so that they can make an informed choice about contacts with these animals. If they choose to be in contact with cats, they can take steps to reduce the risk of acquisition of *T. gondii*. HIV-infected persons with prior *T. gondii* infection may be at reduced risk of disease from re-exposure to *T. gondii*, but this has not been determined. The following precautions should be observed.

1. Cats should be kept indoors, fed only cooked food, kept away from other cats that may be exposed to *T. gondii*, and kept away from potentially infected prey. House mice are a potential source of *T. gondii* for cats if the mice have access to oocysts. If cats have been infected with *T. gondii* just before these measures are instituted, they may shed oocysts during the first few weeks. They are less likely to do so after 3 months.
2. HIV-infected people should avoid handling cat litter. Litter should be cleaned daily to prevent oocysts from sporulating in the litter pan. Dust from the litter may contain oocysts and exposure by inhalation should be avoided. If an HIV-infected person must change cat litter, it should be sprinkled with water first to reduce dust. Masks should not be necessary unless inhalation of dust is unavoidable.
3. Persons handling cats or litter should wash their hands afterward, especially before preparing food. Gloves are not necessary.
4. Persons caring for HIV-infected children or for mentally impaired adults should assess whether cat contact or poor hygiene may result in significant exposure. More stringent protective measures or elimination of cats from the environment may be necessary in such cases.

Meat should be well-cooked before ingestion. Produce should be thoroughly washed before it is eaten. HIV-infected people should only use pasteurized milk or milk products. Cooking also makes produce or milk-containing foods safe.

IgG antibody to *T. gondii* should be measured for those who are HIV positive. If an HIV-infected person with *T. gondii* antibody later presents with a compatible syndrome (*94*), reactivation of *T. gondii* infection should be strongly considered.

Leishmaniasis. Leishmaniasis has been reported in a few HIV-infected people and seems to be atypical and more severe than in other persons (*95, 96*). Leishmaniasis is endemic in China, the Indian subcontinent, the Middle East, the Mediterranean littoral, Africa, and Latin America. Leishmania are spread to humans through the bites of sandflies. These insects tend to live and breed in human habitats, although there are differences between different species and different regions.

Prevention. Prevention is impractical for most residents of endemic areas, but preventive measures can be instituted for short-term residents or travelers. Where practical, people with limited exposures or brief stays in endemic areas should use insect repellents, long-sleeved clothing, and fine-mesh netting to reduce sandfly exposure.

Microsporidian infections. Microsporidia are ubiquitous protozoan parasites of animals, but they have been identified rarely in humans. Microsporidian infections have been reported in persons with AIDS and diarrhea or malabsorption (*97, 98*), and such infections may become more commonly recognized. Transmission most likely occurs from ingestion of cysts in meat.

Prevention. Meat should be cooked to destroy microsporidian cysts.

Fungal infections. Histoplasmosis (*99*), coccidioidomycosis (*100*), cryptococcosis (*101*), and sporotrichosis (*102–104*) are all more common and more severe in HIV-infected people. Soil contaminated with bird or bat feces may contain *Histoplasma capsulatum* or *Cryptococcus neoformans*. Occasional cases of histoplasmosis have resulted when people have cut decayed trees. *Histoplasma* infection is common in river valleys of central and eastern United States, but histoplasmosis has been reported throughout the world. *Cryptococcus* infections occur worldwide. Soil from the semi-arid Lower Sonoran Life Zone in the southwestern United States (Arizona, New Mexico, Nevada, and southwest Utah), northern Mexico, and Central and South America (especially Bolivia, Paraguay, and Argentina) may contain *Coccidioides immitis* arthrospores. The organisms proliferate near rodent nests. Risk factors for acquisition of *Sporothrix*

schenckii include forestry or nursery work and contact with soil or plant material, especially peat moss (*105, 106*) and rose thorns (*107*).

Prevention. HIV-infected people should be advised to wash hands after gardening and other soil contact, to avoid puncture wounds from thorns and slivers, and to avoid working with peat moss. In the Lower Sonoran Life Zone, HIV-infected people should avoid inhaling soil or dust, being outside on particularly dusty days (*108*), disturbing soil near rodent nests, and activities (for example, horse-back riding and excavation) that raise clouds of dust. The risk of coccidioidal infection is highest in the dry season (mid- to late summer in North America). HIV-infected people should be advised to avoid exposure to chicken or pigeon coops, bird roosts, bird-inhabited places (barns, attics, and so forth), and bat-inhabited caves. They should avoid dust created when the soil from these places becomes airborne (for example, during excavation). They should avoid dust from decayed trees that are disturbed or cut.

Hepatitis. Many HIV-infected people are at risk for hepatitis B, C, and δ because risk factors for all four viruses are similar. Hepatitis B is spread parenterally and by sexual or other intimate contact. HIV-infected people are more likely to become chronic carriers after hepatitis B infection (*109*). Hepatitis δ virus depends upon hepatitis B virus for replication. Like hepatitis B virus, it is spread parenterally and through sexual contact (*110*). Hepatitis C virus is often spread parenterally (*111, 112*). There is considerable evidence that hepatitis C virus is spread sexually (*113, 114*), but sexual contact between males does not seem to be as strong a risk factor for hepatitis C virus (*115*) as it is for hepatitis B virus (*113*).

HIV-infected people do not respond as well as controls to hepatitis B vaccine, but a substantial proportion attain antibody levels thought to be protective (*116–119*). There is no vaccine against hepatitis C virus or δ virus, but if hepatitis B vaccine prevents hepatitis B infection, δ virus infection cannot become established.

Prevention. HIV-infected people should be advised to reduce their risk of infection by reducing sexual exposure and use of intravenous drugs.

HIV-infected people susceptible to hepatitis B and likely to have continued exposure to this virus should receive hepatitis B vaccine (*120*). The vaccine can be given to people safely whether or not they have been infected with hepatitis B before (*120*). The question of whether serologic screening should be performed before vaccination with hepatitis B or whether vaccine should just be given to all people should be decided based on the prevalence of prior infection and the costs of screening and vaccination (*120*).

'HIV-infected people should eat meat, poultry, seafood, or eggs only after these foods have been properly cooked. Raw eggs may be unrecognized in some foods, including some preparations of hollandaise sauce, meringue, caesar and certain other salad dressings, frosting, egg nog, ice cream, mayonnaise, and dough.'

Varicella and zoster. Varicella-zoster virus (VZV) is the etiologic agent of varicella (chickenpox) or zoster (shingles). HIV-infected people who have never been infected with VZV are at greater risk for severe disease (*121*). A history of chickenpox in children is usually reliable, and HIV-infected children with such a history are unlikely to be susceptible to VZV infection. Those without a history of chickenpox should be considered susceptible. Relatively few U.S. adults report never having had varicella. Of those, only 5 to 15 percent are truly susceptible (*122*). It appears as if greater numbers of adults from tropical countries are susceptible (*123*).

VZV is thought to be spread by the respiratory route during varicella but not during localized zoster, and varicella is much more contagious than zoster. Varicella-zoster immune globulin (VZIG) has been shown to prevent or ameliorate manifestations of varicella if given within the first 72 hours after exposure (*122*). Varicella vaccine protects healthy people and children with leukemia against varicella (*124*), but tests of safety or efficacy have not been reported for HIV-infected persons. Varicella vaccine is available in some countries, but not currently in the United States.

Prevention. HIV-infected people without a history of varicella (mainly young children) should

avoid exposure to people incubating or ill with varicella or zoster. People with varicella are infectious from 48 hours before onset of the vesicular rash until all vesicles have crusted. Transmission can occur from people with zoster from the time of onset of the rash until all vesicles have crusted.

HIV-infected adults without a history of varicella or zoster who are likely to encounter VZV (for example, have frequent contact with susceptible children or work in health care settings) should have their serum tested for antibody to VZV. If they are exposed to VZV, they should receive VZIG as soon as possible within 72 hours of exposure (*122, 125*). Varicella vaccine is not recommended for HIV-infected people (*124*).

Measles. Measles is more severe in HIV-infected people than in others (*126–129*). Measles vaccine is a live, attenuated virus which can cause severe disease in some immunosuppressed people, but this has not been reported for HIV-infected people (*129–131*). Data on immunogenicity in HIV-infected children are conflicting, but some respond with antibodies (*128, 129, 131*). The efficacy of the vaccine in HIV-infected people is not known (*128, 131*).

Immunoglobulin preparations contain measles antibody and have been recommended to prevent severe measles in exposed HIV-infected people (*44*), even those previously immunized against measles (*128*). Administration of immunoglobulin, intravenously or intramuscularly, prevents antibody responses to measles vaccine given in the ensuing 3 months.

Prevention. HIV-infected people should avoid contact with people with measles until they are no longer contagious. Contagiousness lasts approximately from 5 days after exposure to 1 week after the rash appears.

Measles vaccine has been recommended for both asymptomatic and symptomatic HIV-infected children (*44, 51*). For post-exposure prophylaxis, intramuscular gamma globulin should be given to prevent or ameliorate manifestations of measles in exposed, susceptible HIV-infected people (*44, 128*). Some authors have recommended gamma globulin in exposed HIV-infected persons even if they have received measles vaccine (*128*).

Mumps and rubella. The severity of mumps and rubella does not seem to be increased in HIV-infected people. Although there are theoretical concerns about giving live virus vaccines to HIV-infected people, the risk seems to be minimal (*130, 131*).

Prevention. Mumps and rubella vaccines should be used in HIV-infected people for the usual indications (*44*).

Poliomyelitis. Paralytic poliomyelitis due to live, attenuated polio vaccine is more common in people with some kinds of immunosuppression than in healthy people (*132*). To our knowledge, no cases have been reported in HIV-infected people. Paralytic disease may occur in persons receiving the vaccine or in susceptible household contacts. Both wild and vaccine-type poliomyelitis viruses are spread through the fecal-oral route.

Prevention. Inactivated vaccine should be used in HIV-infected people for the usual indications (*133*), including boosters for significant exposure, such as travel to endemic areas. Household contacts of HIV-infected people who need polio immunization should be given inactivated polio vaccine. If oral, live polio vaccine is used for household contacts, steps to prevent spread of the vaccine strain to the HIV-infected person should be recommended (see the section "Gastrointestinal Diseases").

Influenza. People with AIDS frequently have conditions (for example, chronic respiratory, cardiovascular, metabolic, or renal diseases) that are associated with increased morbidity from influenza, and one study has suggested that HIV-infected people, especially those with AIDS, are unusually susceptible to influenza (*134*). Serologic responses of HIV-infected people to influenza vaccine have been variable (*36, 37, 135*), and there are no data on efficacy in this group.

Prevention. Annual influenza vaccination has been recommended for all HIV-infected people (*136*).

Vaccinia infections. Vaccinia virus (smallpox vaccine) is not recommended for use in the general population, but it is still used in military populations (*137*). It has caused severe disseminated disease in a man with AIDS (*138*).

Prevention. Vaccinia virus should not be given to HIV-infected people.

Special Situations

Travel. HIV-infected people should be informed that there are health consequences of travel, especially to developing countries (*139*). A full discus-

sion of recommendations for travelers is beyond the scope of this article; the reader is referred to other sources (*29, 140, 141*).

Certain aspects of travel are of special significance for HIV-infected people. Food or water may carry pathogens like *Salmonella* that have unusually severe manifestations in HIV-infected people. HIV-associated complications may arise away from home, and travelers should know how to obtain good medical care. Because most complications of HIV infection progress slowly enough to allow travelers to obtain medical care abroad in a timely fashion or to return home, people should not be discouraged from traveling because of HIV infection. The multiple medications given for HIV infection or its complications and for travel may interact, and practitioners should review a patient's medications for this possibility.

Prevention. Counseling of the HIV-infected person who travels should encompass the following precautions.

1. Provide a general list of recommendations about travel that would apply to anyone (*29, 140, 141*). Immunizations, malaria prophylaxis, and diarrheal disease prophylaxis and treatment should be reviewed.
2. Consult with the local or State health department about specific recommendations for the locations to be visited. Alternatively, the Centers for Disease Control operates a computerized telephone hotline with health information about foreign travel on (404) 322-4555.
3. To avoid foodborne infections, (*a*) eat only cooked food that is still hot or produce that can be peeled by the traveler, (*b*) avoid dairy products unless it is known that they were prepared with pasteurized milk, and (*c*) select restaurants likely to prepare food safely.
4. To avoid waterborne infections, drink bottled or canned *carbonated* water or soft drinks, beer, or wine. Unsafe water can be sterilized by boiling for 10 minutes (*29*). Alternatively, water can be treated with iodine (*29*), but this is less reliable than boiling. For clear water, use 5 drops (0.25 milliliter) of 2 percent tincture of iodine per liter or quart of water, or tetraglycine hydroperiodide tablets, according to the manufacturer's directions. (Tetraglycine hydroperiodide tablets are available in pharmacies and sporting goods stores.) Liquid chlorine bleach containing 4 to 6 percent available chlorine can be used to disinfect water (2 to 4 drops [0.1 to 0.2 milliliter] per liter), but chlorine is even less reliable than iodine (*29*). Dosages should be doubled for cloudy water. Filters to sterilize water have been marketed recently, but independent data on their effectiveness have not been published (*29*). Do not use ice unless it is known to have been made with safe water.
5. Provide a list of physicians who can provide care away from home. A pocket directory is available from the International Association for Medical Assistance to Travelers. The address is IAMAT, 736 Center St., Lewiston, NY 14092; tel.: (716-754-4883).
6. Advise people to bring an adequate supply of necessary medications with them and review potential drug interactions.
7. Travelers to areas where leishmaniasis is endemic should use insect repellents, long-sleeved clothing, and fine-mesh netting to reduce sandfly exposure.

Sexually transmitted diseases. STDs are common in some groups at high risk for HIV infection (that is, people with multiple sex partners and intravenous drug users). Many STDs, including syphilis, cytomegalovirus, hepatitis B, and herpes simplex virus, are an important source of morbidity for HIV-infected people. Oral-genital and oral-anal sexual contact can also transmit enteric pathogens (*30–32*). Genital ulcers appear to increase both transmission and acquisition of HIV (*71, 142, 143*). Of course, sexual intercourse may spread HIV from the person being counseled to others.

Aside from these known risks, there are theoretical risks associated with sexual intercourse for HIV-infected people. Immune stimulation caused by STDs may induce active replication of HIV (*144*). Coinfection of HIV-infected cells with other viruses may increase HIV replication by activation of HIV regulatory genes (*145, 146*). There is evidence that human T cell leukemia virus type 1 (HTLV-1) enhances progression of AIDS in HIV-infected people (*146*). Finally, sexual intercourse may also spread other retroviruses including HTLV-1 and HIV-2.

Prevention. The medical counselor of the HIV-infected person should discuss sexual behaviors and practices.

1. Stress the responsibility to prevent transmission of HIV to others.
2. Limit sexual contacts. Abstinence is the most effective protection for HIV-infected persons and others. Second most effective is a relationship in

which both partners are monogamous and have similar HIV infection status.

3. If sexual intercourse is practiced, "safer sex" should be encouraged (*147*). There are various definitions of "safer sex," and none have been systematically studied to determine their efficacy in preventing transmission of STD, including HIV. Nonoxynol-9, a common spermicide, has been shown to kill HIV (*148*) and has been recommended to prevent HIV transmission when infected body fluids are likely to be exchanged. We recommend the following:

- **More safe:** noninsertive activities that do not involve exchange of body secretions (for example, petting or mutual masturbation) and kissing with the mouth closed;
- **Less safe:** vaginal or anal intercourse with a condom and nonoxynol-9 spermicide, oral-genital sex with a condom or dental dam or similar barrier over female genitals, intimate kissing (with exchange of saliva), and urine contact with body orifices, mucous membranes, or wounds;
- **Unsafe:** vaginal or anal intercourse without a condom, oral-genital sex without a condom or dental dam, oral-anal sex (rimming), and manual anal intercourse (fisting).

4. Persons at high risk for STDs should be tested with a nontreponemal antibody test for syphilis, as mentioned earlier, and screened for *Neisseria gonorrhea* and *Chlamydia trachomatis*. Repeated screening for STD pathogens should be considered for people who are in groups at high risk for STD and who continue sexual activity. The screening protocol should take into account the local incidence and prevalence of specific pathogens (*149*).

Illicit drugs. Intravenous drug use commonly leads to secondary infections. If needles are shared, HIV-infected people may become infected with other strains of HIV, other retroviruses, hepatitis B, hepatitis C, hepatitis δ, or other less common agents. HIV-infected people may spread HIV or other blood-borne infections to other users. A variety of strategies to reduce transmission among drug users are currently being studied, including provision of sterile needles (*150, 151*) and recommendations that users clean their needles with household bleach (5.25 percent sodium hypochlorite) (*152*). The effectiveness of recommendations to use bleach has not yet been determined.

Prevention. Illicit drug use should be strongly discouraged. Treatment should be encouraged and provided for users who are willing to accept it. If users fail to stop using intravenous drugs or cannot get into treatment programs (*153*), they should be urged not to share needles. Participation in needle exchange programs should be encouraged where the programs exist (*150, 151*). If needles are used repeatedly, they should be cleaned between uses with bleach (*152*).

Baseline testing and monitoring. The CD4+ (OKT4+, helper) lymphocyte concentration in blood indicates the susceptibility of HIV-infected people to some secondary infectious diseases (*78*). The proportion of lymphocytes that are CD4+ is a related indicator *(78)*. These indicators are used to determine the need for zidovudine (AZT) therapy and primary prophylaxis against *P. carinii* pneumonia (*154–156*). The occurrence of *P. carinii* pneumonia indicates the need for both zidovudine therapy and secondary prophylaxis against recurrent *P. carinii* pneumonia regardless of the CD4+ concentration.

Prevention. The CD4+ lymphocyte concentration should be measured for all HIV-infected people who have not had *P. carinii* pneumonia. Persons with CD4+ concentrations exceeding 500 cells per microliter of blood should have the test repeated at least every 6 months, or sooner if they are considered to be symptomatic from HIV infection.

Antiviral therapy against HIV. Zidovudine has been shown to prevent infections, preserve immune function, and prolong life in certain people with HIV infection (*157*). It is recommended for people with AIDS and for other HIV-infected people with $\leq$ 500 CD4+ lymphocytes per microliter of blood (*154–156*). Recently relatively low doses have been found to be effective and associated with lower toxicity (*158, 159*).

Prevention. Zidovudine (ordinarily 100 milligrams 5 times per day) should be given to HIV-infected people with AIDS or with $\leq$500 CD4+ lymphocytes per microliter of blood (*154–159*).

Immunoglobulin therapy for children with HIV infection. Use of intravenous immunoglobulin has been proposed to prevent serious infections in children with HIV infection. In a recently completed clinical trial (*160*), it was found that 400 milligrams of intravenous immunoglobulin per kilogram of body weight every 28 days prevented serious infec-

tions and reduced the need for hospitalization in children with > 200 CD4+ lymphocytes per microliter of blood and CDC classification P1B, P2A-C, P2D3, or P2DF (*161*). A second trial is still underway.

Prevention. A recommendation is premature at this time. If intravenous immunoglobulin is used, live virus vaccines, particularly measles, mumps, and rubella vaccines, should be given beforehand whenever possible.

References

1. Archer, D. L.: Food counseling for persons infected with HIV: strategy for defensive living. Public Health Rep 104: 196–198, March-April 1989.
2. Griffin, P. M., and Tauxe, R. V.: Food counseling for patients with AIDS. J Infect Dis 158: 668, September 1988.
3. Centers for Disease Control, Food and Drug Administration: Eating defensively: food safety advice for persons with AIDS. September 1989. Distributed by National AIDS Information Clearinghouse; telephone (801) 458-5231.
4. Kanki, P. I., et al.: Human T-lymphotropic virus type 4 and the human immunodeficiency virus in West Africa. Science 236: 827–831, May 15, 1987.
5. Clavel, F., et al.: Human immunodeficiency virus type 2 infection associated with AIDS in West Africa. N Engl J Med 316: 1180–1184, May 7, 1987.
6. Profeta, S., et al.: *Salmonella* infections in patients with acquired immunodeficiency syndrome. Arch Intern Med 145: 670–672, April 1985.
7. Jacobs, J. L., et al.: *Salmonella* infections in patients with the acquired immunodeficiency syndrome. Ann Intern Med 102: 186–188, February 1985.
8. Nadelman, R. B., Mathur-Wagh, U., Yancovitz, S. R., and Mildvan, D.: *Salmonella* bacteremia associated with the acquired immunodeficiency syndrome (AIDS). Arch Intern Med 145: 1968–1971, November 1985.
9. Smith, P. D., et al.: *Salmonella typhimurium* enteritis and bacteremia in the acquired immunodeficiency syndrome. Ann Intern Med 102: 207–210, February 1985.
10. Chaisson, R. E.: Infections due to encapsulated bacteria, Salmonella, Shigella, and Campylobacter. Infect Dis Clin North Am 2: 475–484, June 1988.
11. Perlman, D. M., et al.: Persistent Campylobacter jejuni infections in patients infected with human immunodeficiency virus (HIV). Ann Intern Med 108: 540–546, April 1988.
12. Crawford, F. G.: Human cryptosporidiosis. CRC Crit Rev Microbiol 16: 113–159 (1988).
13. Soave, R., and Johnson, W. D.: *Cryptosporidium* and *Isospora belli* infections. J Infect Dis 157: 225–229, February 1988.
14. DeHovitz, J. A., Pape, J. W., Boncy, M., and Johnson, W. D.: Clinical manifestations and therapy of *Isospora belli* infection in patients with the acquired immunodeficiency syndrome. New Engl J Med 315: 87–90, July 10, 1986.
15. Janoff, E. N., Smith, P. D., and Blaser, M. J.: Acute antibody responses to *Giardia lamblia* are depressed in patients with AIDS. J Infect Dis 157: 798–804, April 1988.
16. Holmberg, S. D., Osterholm M. T., Senger, K. A., and Cohen M. L.: Drug-resistant salmonella from animals fed antimicrobials. N Engl J Med 311: 617–622, Sept. 6, 1984.
17. Holmberg, S. D., Wells, J. G., and Cohen, M. L.: Animal-to-man transmission of antimicrobial-resistant *Salmonella*: Investigations of U.S. outbreaks, 1971–1983. Science 225: 833–835, Aug. 24, 1984.
18. O'Brien, T. F., et al: Molecular epidemiology of antibiotic resistance in salmonella from animals and human beings in the United States. N Engl J Med 307: 1–6, July 1, 1982.
19. Potter, M. E., Kaufmann, A. F., Blake, P. A., and Feldman, R. A.: Unpasteurized milk: the hazards of a health fetish. JAMA 252: 2048–2052, Oct. 19, 1984.
20. Aserkoff, B., Schroeder, S. A., and Brachman, P. S.: Salmonellosis in the United States—a five-year review. Am J Epidemiol 92: 13–24, July 1970.
21. Hughes, J. M., Merson, M. H., and Gangarosa, E. J.: The safety of eating shellfish. JAMA 237: 1980–1981, May 2, 1977.
22. Lumsden, L. L., Hasseltine, H. E., Leake, J. P., and Weldee, M. V.: A typhoid fever epidemic caused by oyster-borne infection (1924–1925). Public Health Rep (suppl) 50: 1–102, January 1925.
23. Tauxe, R. V., Rigau-Pérez, J. G., Wells, J. G., and Blake, P. A.: Turtle-associated salmonellosis in Puerto Rico. JAMA 254: 237–239, July 12, 1985.
24. Chiodini, R. J., and Sundberg, J. P.: Salmonellosis in reptiles. A review. Am J Epidemiol 113: 494–499, February 1981.
25. Woodruff, B. A., Pavia, A. T., and Blake, P. A.: A new look at typhoid vaccination. Information for the practicing physician. JAMA 265: 756–759, Feb. 13, 1991.
26. D'Antonio, R. G., et al.: A waterborne outbreak of cryptosporidiosis in normal hosts. Ann Intern Med 103: 886–888, December 1985.
27. Janoff, E. N., and Reller, L. B.: *Cryptosporidium* species, a protean protozoan. J Clin Microbiol 25: 967–975, June 1987.
28. Soave, R., and Armstrong, D.: *Cryptosporidium* and cryptosporidiosis. Rev Infect Dis 8: 1012–1023, November-December 1986.
29. Centers for Disease Control: Health information for international travel. HHS Publication No. (CDC) 90-8280. U.S. Government Printing Office, Washington, DC, 1990.
30. Kazal, H. L., et al.: The gay bowel syndrome: clinicopathologic correlation in 260 cases. Ann Clin Lab Sci 6: 184–192, March-April 1976.
31. Sohn, N., and Robilotti, J. G.: The gay bowel syndrome: a review of colonic and rectal conditions in 200 male homosexuals. Am J Gastroenterol 67: 478–484, May 1977.
32. Dritz, S. K., et al.: Patterns of sexually transmitted enteric diseases in a city. Lancet No. 8027: 3–4, July 2, 1977.
33. Simberkoff, M. S., El Sadr, W., Schiffman, G., and Rahal, J. J., Jr.: *Streptococcus pneumoniae* infections and bacteremia in patients with acquired immune deficiency syndrome, with report of a pneumococcal vaccine failure. Am Rev Resp Dis 130: 1174–1176, December 1984.
34. Polsky, B., et al.: Bacterial pneumonia in patients with acquired immune deficiency syndrome. Ann Intern Med 104: 38–41, January 1986.
35. Redd, S. C., et al.: Pneumococcal bacteremia in San Francisco residents with HIV infection. *In* Proceedings of the 27th Interscience Conference on Antimicrobial Agents

and Chemotherapy, Los Angeles, CA, Oct. 23-26, 1988, abstract 569.
36. Huang, K. L., et al.: Antibody responses after influenza and pneumococcai immunization in HIV-infected homosexual men. JAMA 257: 2047-2050, Apr. 17, 1987.
37. Ragni, M. V., et al.: Antibody responses to immunization of patients with hemophilia with and without evidence of human immunodeficiency virus (human T-lymphotropic virus type III) infection. J Clin Lab Med 109: 545-549, May 1987.
38. Ammann, A. J., et al.: B-cell immunodeficiency in acquired immune deficiency syndrome. JAMA 251: 1447-1449, Mar. 16, 1984.
39. Nelson, K. E., et al.: The effect of HIV infection on antibody responses to influenza and pneumococcal vaccines. *In* Proceedings of the 27th Interscience Conference on Antimicrobial Agents and Chemotherapy, Los Angeles, CA, Oct. 23-26, 1988, abstract 856.
40. Janoff, E. N., et al.: Class-specific antibody response to pneumococcal capsular polysaccharides in men infected with human immunodeficiency virus type I. J Infect Dis 158: 983-990, November 1988.
41. Recommendations of the immunization practices advisory committee. Pneumococcal polysaccharide vaccine. MMWR 38: 64-76, Feb. 10, 1989.
42. Janoff, E. N., Worel, S., and Douglas, J. M.: Natural immunity and response to conjugate vaccine for *Haemophilus influenzae* type b in men with HIV. *In* Proceedings of the 30th Interscience Conference on Antimicrobial Agents and Chemotherapy, Atlanta, GA, Oct. 21-24, 1990, abstract 609.
43. Steinhoff, M. D., et al.: Effect of protein conjugation on immune response of HIV-infected adults to *H. influenzae* type b (HIB) polysaccharide (PS) vaccine. *In* Proceedings of the 30th Interscience Conference on Antimicrobial Agents and Chemotherapy, Atlanta, GA, 21-24, 1990, abstract 608.
44. Immunization of children infected with human immunodeficiency virus—supplementary ACIP statement. MMWR 37: 181-183, Apr. 1, 1988.
45. Update: prevention of *Haemophilus influenzae* type b disease. MMWR 37: 13-16, Jan. 22, 1988.
46. Chaisson, R. E., et al.: Tuberculosis in patients with the acquired immunodeficiency syndrome. Am Rev Resp Dis 136: 570-574, April 1987.
47. Tuberculosis and human immunodeficiency virus infection: recommendations of the advisory committee for the elimination of tuberculosis. MMWR 38: 236-238, 243-250, Apr. 14, 1989.
48. Selwyn, P. A., et al.: A prospective study of the risk of tuberculosis among intravenous drug users with human immunodeficiency virus infection. N Engl J Med 320: 545-550, Mar. 2, 1989.
49. Reider, H. L., et al.: Tuberculosis and acquired immunodeficiency syndrome—Florida. Arch Intern Med 149: 1268-1273, June 1989.
50. Sundaram, G., McDonald, R. J., and Maniatis, T.: Tuberculosis as a manifestation of the acquired immunodeficiency syndrome. JAMA 256: 362-366, July 18, 1986.
51. World Health Organization: Special programme on AIDS and expanded programme on immunization—joint statement: consultation on human immunodeficiency virus (HIV) and routine childhood immunization. Wkly Epidemiol Rec 62: 297-299, Oct. 2, 1987.
52. Disseminated *Mycobacterium bovis* infection from BCG vaccination of a patient with acquired immunodeficiency syndrome. MMWR 34: 227-228, Apr. 26, 1985.
53. Blanche, S., et al.: Longitudinal study of 18 children with perinatal LAV/HTLV III infection: attempt at prognostic evaluation. J Pediatr 109: 965-970, December 1986.
54. Samies, J. H., et al.: Lung abscess due to *Corynebacterium equi*. Report of the first case in a patient with acquired immunodeficiency syndrome. Am J Med 80: 685-688, April 1986.
55. Van Etta, L., Filice, G. A., Ferguson, R. M., and Gerding, D. N.: *Corynebacterium equi*: a review of 12 cases of human infection. Rev Infect Dis 5: 1012-1018, November-December 1983.
56. Blake, P. A.: Vibrios on the half shell: what the walrus and the carpenter didn't know. Ann Intern Med 99:558-560, October 1983.
57. Tacket, C. O., Brenner, F., and Blake, P. A.: Clinical features and an epidemiological study of *Vibrio vulnificans* infections. J Infect Dis 149: 558-561, April 1984.
58. Johnston, J. M., Becker, S. F., and McFarland, L. M.: Vibrio vulnificans. Man and the sea. JAMA 253: 2850-2853, May 17, 1985.
59. Blake, P. A., et al.: Cholera—a possible endemic focus in the United States. N Eng J Med 302: 305-309, Feb. 7, 1980.
60. Chin, K. P., Lowe, M. A., Tong, M. J., and Koehler, A. L.: *Vibrio vulnificans* infection after raw oyster ingestion in a patient with liver disease and acquired immune deficiency syndrome-related complex. Gastroenterology 92: 796-799, March 1987.
61. Mascola, L., et al.: Listeriosis: an uncommon opportunistic infection in patients with acquired immunodeficiency syndrome. A report of five cases and a review of the literature. Am J Med 84: 162-164, January 1988.
62. Patey, O., et al.: *Listeria monocytogenes* septicemia in an AIDS patient with a brain abscess. Eur J Clin Microbiol Infect Dis 8: 746-748, August 1989.
63. Harris, J. O., Marquez, J., Swerdloff, M. A., and Magana, I. A.: Listeria brain abscess in the acquired immunodeficiency syndrome. Arch Neurol 46: 250, March 1989.
64. Harvey, R. L., and Chandrasekar, P. H.: Chronic meningitis caused by Listeria in a patient infected with human immunodeficiency virus. J Infect Dis 157: 1091-1092, May 1988.
65. Gould, I. A., Belok, L. C., and Handwerger, S.: *Listeria monocytogenes*: a rare cause of opportunistic infection in the acquired immunodeficiency syndrome (AIDS) and a new cause of meningitis in AIDS. A case report. AIDS Res 2: 231-234, summer 1986.
66. Beninger, P. R., Savoia M. C., and Davis, C. E.: *Listeria monocytogenes* meningitis in a patient with AIDS-related complex. J Infect Dis 158: 1396-1397, December 1988.
67. Berenguer, J., et al.: Listeriosis in patients infected with human immunodeficiency virus. Rev Infect Dis 13: 115-119, January-February 1991.
68. Kales, C. P., and Holzman, R. S.: Listeriosis in patients with HIV infection: clinical manifestations and response to therapy. J Acq Immune Defic Syndr 3: 139-143, February 1990.
69. Gellin, B., and Broome, C. V.: Listeriosis. JAMA 261: 1313-1320, Mar. 3, 1989.
70. Jacobs, J. L., and Murray, H. W.: Why is *Listeria monocytogenes* not a pathogen in the acquired immunodeficiency syndrome? Arch Intern Med 146: 1299-1300, July 1986.

71. Hook, E. W., III: Syphilis and HIV infection. J Infect Dis 160: 530–534, September 1989.
72. Musher, D. M., Hamill, R. J., and Baughn, R. E.: Effect of human immunodeficiency virus (HIV) infection on the course of syphilis and on the response to treatment. Ann Intern Med 113: 872–881, Dec. 1, 1990.
73. Schlossberg, D., et al.: Culture-proved disseminated cat-scratch disease in acquired immunodeficiency syndrome. Arch Intern Med 149: 1437–1439, June 1989.
74. Kemper, C. A., Lombard, C. M., Deresinski, S. C., and Tompkins, L. S.: Visceral bacillary epithelioid angiomatosis: possible manifestations of disseminated cat scratch disease in the immunocompromised host: a report of two cases. Am J Med 89: 216–222, August 1990.
75. Relman, D. A., et al.: The agent of bacillary angiomatosis. An approach to the identification of uncultured pathogens. N Engl J Med 323: 1573–1580, Dec. 6, 1990.
76. Perkocha, L. A., et al.: Clinical and pathological features of bacillary peliosis hepatis in association with human immunodeficiency virus infection. N Engl J Med 323: 1581–1586, Dec. 6, 1990.
77. Slater, L. N., Welch, D. F., Hensel, D, and Coody, D. W.: A newly recognized fastidious gram-negative pathogen as a cause of fever and bacteremia. N Engl J Med 323: 1587–1592, Dec. 6, 1990.
78. Masur, H., et al.: CD4 counts as predictors of opportunistic pneumonias in human immunodeficiency virus (HIV) infection. Ann Intern Med 111: 223–231, Aug. 1, 1989.
79. Guidelines for prophylaxis against *Pneumocystis carinii* pneumonia for persons infected with human immunodeficiency virus. MMWR 38 (no. S-5): 1–9, June 16, 1989.
80. Kovacs, J. A., and Masur, H.: Prophylaxis of *Pneumocystis carinii* pneumonia. J Infect Dis 160: 882–886, November 1989.
81. Kovaks, J. A., and Masur, H.: *Pneumocystis carinii* pneumonia: therapy and prophylaxis. J Infect Dis 158: 254–259, July 1988.
82. Masur, H, et al.: Pneumocystis pneumonia: from bench to clinic. Ann Intern Med 111: 813–826, Nov. 15, 1989.
83. Grant, I. H., Gold, J. W. M., and Armstrong, D.: Risk of CNS toxoplasmosis in patients with acquired immune deficiency syndrome. *In* Proceedings of the 26th Interscience Conference on Antimicrobial Agents and Chemotherapy, New Orleans, LA, Sept. 28–Oct. 1, 1986, abstract 441.
84. Luft, B. J., et al.: Toxoplasmic encephalitis in patients with AIDS. JAMA 252: 913–917, Aug. 17, 1984.
85. Israelski, D. M., and Remington, J. S.: Toxoplasmic encephalitis in patients with AIDS. Infect Dis Clin North Am 2: 429–445, June 1988.
86. Jacobs, L., Remington, J. S., and Melton, M. L.: The resistance of the encysted form of *Toxoplasma gondii*. J Parasitol 46: 11–21, February 1960.
87. Sacks, J. J., Roberto, R. R., and Brooks, N. F.: Toxoplasmosis infection associated with raw goat's milk. JAMA 248: 1728–1732, Oct. 8, 1982.
88. Teutsch, S. M., et al.: Epidemic toxoplasmosis associated with infected cats. N Engl J Med 300: 695–699, Mar. 29, 1979.
89. Chessum, B. S.: Reactivation of *Toxoplasma* oocyst production in the cat by infection with *Isospora felis*. Br Vet J 128: 33–36, July 1972.
90. Dubey, J. P.: Reshedding of *Toxoplasma gondii* oocysts by chronically infected cats. Nature (London) 262: 213–214, July 15, 1976.
91. Barbier, D., Ancelle, T., and Martin-Bouyer, G.: Seroepidemiological survey of toxoplasmosis in La Guadeloupe, French West Indies. Am J Trop Med Hyg 32: 935–942, May 1983.
92. Frenkel, J. K., and Ruiz, A.: Endemicity of toxoplasmosis in Costa Rica. Transmission between cats, soil, intermediate hosts and humans. Am J Trop Med Hyg 6: 1161–1166, November 1980.
93. Stagno, S., et al.: An outbreak of toxoplasmosis linked to cats. Pediatrics 65: 706–712, April 1980.
94. Navia, B. A, et al.: Cerebral toxoplasmosis complicating the acquired immune deficiency syndrome: clinical and neuropathological findings in 27 patients. Ann Neurol 19: 224–238, March 1986.
95. Berenguer, J., et al.: Visceral leishmaniasis in patients infected with human immunodeficiency virus (HIV). Ann Intern Med 111: 129–132, July 15, 1989.
96. Montalban, C., et al.: Visceral leishmaniasis in patients infected with human immunodeficiency virus. J Infect 21: 261–270, November 1990.
97. Terada, S., et al.: Microsporidian hepatitis in the acquired immunodeficiency syndrome. Ann Intern Med 107: 61–63, July 1987.
98. Kotler, D. P., et al.: Small intestinal injury and parasitic diseases in AIDS. Ann Intern Med 113: 444–449, Sept. 15, 1990.
99. Johnson, P. C., et al.: Progressive disseminated histoplasmosis in patients with AIDS. Am J Med 85: 152–158, August 1988.
100. Bronnimann, D., et al.: Coccidioidomycosis in the acquired immunodeficiency syndrome. Ann Intern Med 106: 372–379, March 1987.
101. Chuck, S. L., and Sande, M. A.: Infections with *Cryptococcus neoformans* in the acquired immunodeficiency syndrome. N Engl J Med 321: 794–799, Sept. 21, 1989.
102. Lipstein-Kresch, E., et al.: Disseminated *Sporothrix schenckii* infection with arthritis in a patient with acquired immunodeficiency syndrome. J Rheumatol 12: 805–808, April 1985.
103. Bibler, M. R., Luber, H. J., Glueck, H. I., and Estes, S. A.: Disseminated sporotrichosis in a patient with HIV infection after treatment for acquired factor VIII inhibitor. JAMA 256: 3125–3126, Dec 12, 1986.
104. Kurosawa, A., et al.: *Sporothrix schenckii* endophthalmitis in a patient with human immunodeficiency virus infection. Arch Ophthamol 106: 376–380, March 1988.
105. Multistate outbreak of sporotrichosis in seedling handlers, 1988. MMWR 37: 652–653, Oct. 21, 1988.
106. Powell, K. E., et al.: Cutaneous sporotrichosis in forestry workers. Epidemic due to contaminated sphagnum moss. JAMA 240: 232–235, July 21, 1978.
107. Kedes, L. H., Siemienski, I., and Braude, A. I.: The syndrome of the alcoholic rose gardener. Sporotrichosis of the radial tendon sheath. Report of a case cured with amphotericin B. Ann Intern Med 61: 1139–1141, July 1964.
108. Flynn, N. M., et al.: An unusual outbreak of windborne coccidioidomycosis. N Engl J Med 301: 358–361, Aug. 16, 1979.
109. Hadler, S. C.: Hepatitis B prevention and human immunodeficiency virus. Ann Intern Med 108: 92–94, January 1988.
110. Solomon, R. E., et al.: Human immunodeficiency virus and hepatitis delta virus in homosexual men. A study of four cohorts. Ann Intern Med 108: 51–54, January 1988.

111. Kuo, G., et al.: An assay for circulating antibodies to a major etiologic virus of human non-A, non-B hepatitis. Science 244: 362–364, Apr. 21, 1989.
112. Alter, H. I., et al.: Detection of antibody to hepatitis C virus in prospectively followed transfusion recipients with acute and chronic non-A, non-B hepatitis. N Engl J Med 321: 1494–1500, Nov. 30, 1989.
113. Alter, M. I., et al.: Risk factors for acute non-A, non-B hepatitis in the United States and association with hepatitis C infection. JAMA 264: 2231–2235, Nov. 7, 1990.
114. Hess, G., et al.: Hepatitis C virus and sexual transmission. Lancet No 8669: 987, Oct. 21, 1989.
115. Mortimer, P. P., et al.: Hepatitis C virus antibody. Lancet No. 8666: 798, Sept. 30, 1989.
116. Zanetti, A. R., et al.: Hepatitis B vaccination of 113 hemophiliacs: Lower antibody response in anti-LAV/HTLV-III-positive patients. Am J Hematol 23: 339–345, June 1986.
117. Carne, C. A., et al.: Impaired responsiveness of homosexual men with HIV antibodies to plasma derived hepatitis B vaccine. Brit Med J 294: 866–868, April 1987.
118. Drake, J. H., Parmley, R. T., and Britton, H. A.: Loss of hepatitis B antibody in human immunodeficiency virus-positive hemophilia patients. Pediatr Infect Dis J 6: 1051–1054, March 1987.
119. Collier, A. C., Corey, L., Murphy, V. L., and Handsfield, H. H.: Antibody to human immunodeficiency virus (HIV) and suboptimal response to hepatitis B vaccination. Ann Intern Med 109: 101–105, July 15, 1988.
120. Recommendations for protection against viral hepatitis. MMWR 34: 313–324, 329–335, June 7, 1985.
121. Pahwa, S., et al.: Continuous varicella-zoster infection associated with acyclovir resistance in a child with AIDS. JAMA 260: 2879–2882, Nov. 18, 1988.
122. Centers for Disease Control: Varicella-zoster immune globulin for the prevention of chickenpox. Recommendations of the Immunization Practices Advisory Committee. Ann Intern Med 100: 859–865, December 1984.
123. Weller, T. H.: Varicella and herpes zoster. Changing concepts of the natural history, control, and importance of a not-so-benign virus. N Engl J Med 309: 1362–1368, 1434–1440, Dec. 8, 1983.
124. Hardy, I. R. B., and Gershon, A. A.: Prospects for use of a varicella vaccine in adults. Infect Dis Clin North Am 4: 159–173, March 1990.
125. Straus, S. E., et al.: Varicella-zoster virus infections. Biology, natural history, treatment, and prevention. Ann Intern Med 108: 221–237, February 1988.
126. Measles in HIV-infected children. MMWR 37: 183–186, Apr. 1, 1988.
127. Markowitz, L. E., et al.: Fatal measles pneumonia without rash in a child with AIDS. J Infect Dis 158: 480–483, August 1988.
128. Krasinski, K., and Borkowsky, W.: Measles and measles immunity in children infected with human immunodeficiency virus. JAMA 261: 2512–2516, May 5, 1989.
129. Oxtoby, M. J., et al.: Measles and measles immunization in African children with human immunodeficiency virus. *In* Proceedings of the 30th Interscience Conference on Antimicrobial Agents and Chemotherapy, Atlanta, GA, Oct. 21–24, 1990, abstract 1353.
130. McLaughlin, M., et al.: Live virus vaccines in human immunodeficiency virus-infected children: a retrospective survey. Pediatrics 82: 229–233, August 1988.
131. von Reyn, C. F., Clements, C. J., and Mann, J. M.: Human immunodeficiency virus infection and routine childhood immunization. Lancet No. 8560: 669–672, Sept. 24, 1987.
132. Poliomyelitis prevention. MMWR 31: 22–26, Jan. 29, 1982.
133. Poliomyelitis prevention: enhanced-potency inactivated poliomyelitis vaccine—supplementary statement. MMWR 36: 795–798, Dec. 11, 1987.
134. Thurn, J. R., and Henry, K.: Influenza A pneumonitis in a patient infected with the human immunodeficiency virus (HIV). Chest 95: 807–810, October 1989.
135. Nelson, K. E., et al.: The influence of human immunodeficiency virus (HIV) infection on antibody responses to influenza vaccines. Ann Intern Med 109: 383–388, September 1988.
136. Prevention and control of influenza: part I, vaccines. MMWR 38: 297–298, 303–311, May 5, 1989.
137. Capps, L., Vermund, S. H., and Johnsen, C.: Smallpox and biological warfare: the case for abandoning vaccination of military personnel. Am J Public Health 76: 1229–1231, October 1986.
138. Redfield, R. R., et al.: Disseminated vaccinia in a military recruit with human immunodeficiency virus (HIV) disease. N Engl J Med 316: 673–676, Mar. 12, 1987.
139. Taylor, D. N., Pollard, R. A., and Blake, P. A.: Typhoid in the United States and the risk to the international traveler. J Infect Dis 148: 599–602, September 1983.
140. Wolfe, M. S.: Protection of travelers. *In* Principles and practice of infectious diseases, G.L. Mandell, R.G. Douglas, Jr., and J.E. Bennett, editors. Ed. 3. Churchill Livingstone, New York, NY, 1990; pp. 2334–2340.
141. Hill, D. R., and Pearson, R. D.: Health advice for international travel. Ann Intern Med 108: 839–852, June 1988.
142. Simonsen, J. N., et al.: Human immunodeficiency virus infection among men with sexually transmitted diseases. Experience from a center in Africa. N Engl J Med 319: 274–278, Aug. 4, 1988.
143. Holmberg, S. D., Horsburgh, C. R., Ward, J. W., and Jaffe, H. W.: Biologic factors in the sexual transmission of human immunodeficiency virus. J Infect Dis 160: 116–125, July 1989.
144. Seligmann, M., et al.: Immunology of human immunodeficiency virus infection and the acquired immunodeficiency syndrome. Ann Intern Med 107: 234–242, August 1987.
145. Gendelman, H. E., et al.: Trans-activation of the human immunodeficiency virus long terminal repeat sequence by DNA viruses. Proc Natl Acad Sci USA 83: 9759–9763, December 1986.
146. Gallo, R. C.: Mechanism of disease induction by HIV. J Acq Immune Defic Syndr 3: 380–389, April 1990.
147. Friedland, G. H., and Klein, R. S.: Transmission of the human immunodeficiency virus. N Engl J Med 317: 1125–1134, Oct. 29, 1987.
148. Hicks, D. R., et al.: Inactivation of HTLV-III/LAV-infected cultures of normal human lymphocytes by nonoxynol-9 in vitro. Lancet No. 8469/70: 1422–1423, Dec. 21/28, 1985.
149. Cates, W., Jr.: Control of sexually transmitted diseases: strategic evolution. Infect Dis Clin North Am 1: 1–23, August 1987.
150. Stimson, G. V.: Injecting equipment exchange schemes in England and Scotland. NIDA Res Monogr 80: 89–99 (1988).
151. Saxon, A.J., Calsyn, D.A., Whittaker, S., and Freeman, G., Jr.: Needle obtainment and cleaning habits of addicts.

NIDA Res Monogr 95: 418 (1989).
152. Newmeyer, J. A.: Why bleach? Fighting AIDS contagion among intravenous drug users: the San Francisco experience. J Psychoactive Drugs 20: 159–163, April-June 1988.
153. Watkins, J. D., et al.: Interim report of the Presidential Commission on the Human Imunodeficiency Virus Epidemic: chairman's recommendations—-part I. J Acq Immune Defic Syndr 1: 69–103, February 1988.
154. Broder, S, Mitsuya, H., Yarchoan, R., and Pavlakis, G. N.: Antiretroviral therapy in AIDS. Ann Intern Med 113: 604–618, Oct. 15, 1990.
155. Fischl, M. A., et al.: The safety and efficacy of zidovudine (AZT) in the treatment of patients with mildly symptomatic human immunodeficiency virus infection: a double-blind, placebo-controlled trial. Ann Intern Med 112: 727–737, May 15, 1990.
156. Volberding, P. A., et al.: Zidovudine in asymptomatic human immunodeficiency virus infection. A controlled trial in persons with fewer than 500 CD4-positive cells per cubic millimeter. N Engl J Med 322: 941–949, Apr. 5, 1990.
157. Yarchoan, R., Mitsuya, H., Myers, C. E., and Broder, S.: Clinical pharmacology of 3'-azido-2',3'-dideoxythymidine (zidovudine) and related dideoxynucleosides. New Engl J Med 321: 726–738, Sept. 14, 1989.
158. Collier, A. C., et al.: A pilot study of low-dose zidovudine in human immunodeflciency virus infection. N Engl J Med 323: 1015–1021, Oct. 11, 1990.
159. Fischl, M. A., et al.: A randomized controlled trial of a reduced daily dose of zidovudine in patients with the acquired immunodeficiency sydrome. N Engl J Med 323: 1009–1014, Oct. 11, 1990.
160. NICHD Intravenous Immunoglobulin Study Group: Efficacy of intravenous immunoglobulin in the prophylaxis of serious bacterial infections in children with symptomatic human immunodeficiency virus infection. N Engl J Med. In press.
161. Classification system for human immunodeficiency virus (HIV) infection in children under 13 years of age. MMWR 36: 225–230, 235, 236, Apr. 24, 1987.

A Survey of Newspaper Coverage of HCFA Hospital Mortality Data

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Synopsis

A study that assessed newspaper coverage of the 1986 Hospital Mortality Data for Medicare Patients released by the Health Care Financing Administration (HCFA) of the U.S. Department of Health and Human Services is described. Media interpretation of Federal information about the quality of hospital medical care is also discussed.

A sample of 68 articles from newspapers serving urban areas of various sizes in all regions of the United States was analyzed. Articles were coded into classifications according to how the news was played, headline bias (positive-negative-neutral), hospital mentions, quote sources, explanations for excessively high mortality rates, urban area population, and geographic region.

The findings indicated that HCFA's release of the 1986 hospital mortality data received heavy news coverage. There were twice as many negative headlines as positive ones, although nearly 95 percent of the hospitals had mortality rates within expected ranges. Quotes from representatives of hospitals predominated in the newspaper articles, and they often blamed some aspect of the HCFA data for higher-than-expected mortality rates.

Newspaper attention to the quality of hospital care clearly raised consumer awareness of the idea that health care quality can vary. The newspaper articles, however, provided no guidance on obtaining valid data or on using it to make health care choices.

FOR THE FIRST TIME, information on the quality of health care is being made available to American consumers by government agencies, consumer organizations, mass media, and the health care industry itself (*1,2*). One of the more noteworthy examples of this is the Hospital Mortality Data for Medicare Patients released by the Health Care Financing Administration (HCFA) of the U.S. Department of Health and Human Services. The data reported hospital-specific mortality rates for Medicare pa-